

Notes on Australian Muscoidea (Calyptrata).

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(Tabled before the Royal Society of Queensland, 27th November, 1933).

As the *Muscoidea Calyptrata* is an important section of the economic *Diptera*, it is essential to have a sound classification of its various constituent parts. In the "Insects of Australia and New Zealand," R. J. Tillyard has incorporated the view that the *Sarcophagidae* are true *Tachinids* morphologically (p. 373), and the *Calliphorinae* are true *Muscids* (p. 374). This is certainly disputable, nevertheless it is typical of the confusion of thought concerning the value of the various characters responsible for such views; it also entirely ignores biological considerations. In the present notes the value of families and subfamilies is arbitrary but it is essential to use the terms in order to give some relative value to the groups as they are defined and found to be biological units. Moreover, the main consideration given in this treatment lies fundamentally in a study of the genital complex of the male, which hitherto seems to have been neglected but is now found to yield values of real phylogenetic significance. Special attention is drawn to this factor where it is inconsistent with accepted classifications.

The four families given below and the subfamilies of the *Calliphorinae* are all well recognised sections.

Key to the families of the *Muscoidea Calyptrata*.

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|--|----------------------|
| 1. With mouth-parts vestigial. | <i>Oestridae</i> |
| With mouth-parts functional and normally developed | 2 |
| 2. Lower squama always larger and longer than upper squama. | |
| Hypopleura with bristles. Sternopleural bristles, when | |
| three present, arranged 2 : 1 or 1 : 1 : 1 | 3 |
| Lower squama sometimes very small. Hypopleura never with | |
| bristles (or rarely so in exotic forms). Sternopleural | |
| bristles, when three present, arranged 1 : 2 | <i>Muscidae</i> |
| 3. Postscutellum, in profile, showing a more or less sinuous line, | |
| the upper part being concave and without a protruding | |
| surface there. Or failing this, the upper concave part | |
| may be absent, the lower convex part being joined direct to | |
| the underside of the scutellum | <i>Calliphoridae</i> |
| Postscutellum always with a protruding convex surface on | |
| upper part. This may be in the form of a small pro- | |
| truberance leaving much of the convex surface to view, or | |
| it may be any larger size until the whole of the convex | |
| area is occupied by it, thus showing two large | |
| convex areas below scutellum | <i>Tachinidae</i> |

FAMILY MUSCIDAE.

Key to the subfamilies of *Muscidae*.

- | | |
|--|-----------------|
| 1. Lower squama broad, the inner margin lying below the scutellum. | |
| The first median vein strongly bent upwards and usually | |
| reaching the costa well above the apex of the wing | <i>Muscinae</i> |
| Lower squama narrower, the inner margin lying remote from | |
| the scutellum. The first median vein meeting the costa | |
| usually below the apex of the wing, rarely at apex | 2 |

- | | |
|--|---------------------|
| 2. Proboscis permanently projecting and long ; blood-sucking flies | <i>Stomoxydinae</i> |
| Proboscis retractile | 3 |
| 3. Palpi strongly expanding at apex | <i>Lispinae</i> |
| Palpi normal | 4 |
| 4. Anal vein very short, reaching less than half way between anal cell and wing border | <i>Fanniinae</i> |
| Anal vein longer, reaching over half way between anal cell and wing border | 5 |
| 5. Anal vein not traceable to wing border | <i>Phaoniinae</i> |
| Anal vein traceable to wing border | <i>Anthomyiinae</i> |

The *Coenosiniinae*, a very small subfamily, has been too ill defined to permit its acceptance at present as a separate unit, and is best included under *Phaoniinae* which is a very large subfamily, well represented by numerous species in Australia, and capable of tribal subdivision.

FAMILY CALLIPHORIDAE.

Key to subfamilies of the *Calliphoridae*.

- | | |
|---|----------------------|
| 1. Postscutellum with the upper portion (normally indicated by a convex area) eliminated by reduction, the convex lower portion becoming adjacent to the scutellum. If not quite reaching this stage, then most sternites being hidden by the tergites meeting along the ventral line will indicate this group as all others have the sternites broadly visible | <i>Metopiinae</i> |
| Postscutellum conspicuously concave on its upper part and normal | 2 |
| 2. Palpi flat and very broad, or if narrow and compressed (<i>Metalia</i>) then with abundant long bristles on thorax .. | <i>Rhiniinae</i> |
| Palpi cylindrical, club-shaped, or if compressed provided with short, scanty and unnoticeable bristles on thorax .. | 3 |
| 3. External posthumeral bristle placed nearer the median line, or more or less in a line with the presutural bristle. Always grey species with tessellated abdomen | <i>Sarcophaginae</i> |
| External posthumeral bristle placed very much further away from the median line than the presutural bristle | 4 |
| 4. Palpi flattened, and bristles of thorax scanty | <i>Chrysomyiinae</i> |
| Palpi always cylindrical and more or less clubshaped. Bristles of thorax plentiful and long | <i>Calliphorinae</i> |

It is customary to place the *Metopiinae* as part of the *Sarcophaginae*, but structurally and biologically they stand quite apart, hence are best separated. The *Calliphorinae*, *Chrysomyiinae* and genus *Metallea* of the *Rhiniinae* form another unit, perhaps of the same category, whilst the more typical *Rhiniini* form yet another unit, one having features approaching the *Muscidae* and found nowhere else in the *Calliphoridae*. Also, some of the males are found hovering in the air, a habit the group shares with certain *Muscidae* and is otherwise foreign to the *Calliphorine* element.

In no case have I found the absence of a large superstructure surrounding the gonopore in the subfamily *Sarcophaginae* and the nature seems to be limited to the group. In all other *Calliphoridae* examined, the gonopore lies at the end of a central tube which has a more or less funnel-shaped apex, and is supported by a pair of lateral struts. The nature of the tube and struts is confined to the basal section in *Sarcophaginae* and the superstructure has become the dominant feature of the aedeagus.

FAMILY TACHINIDAE.

In Australia this family is usually divided roughly into three main sections, but it is essential to add a fourth in order to clarify the classification. Clear definitions of these divisions and those of tribal value have not been given, for the limits are not ascertained,

nevertheless, the following will enable about 95 per cent. of those collected to be relegated to their correct position. Hitherto, no account has been given to show the part the genital complex can play in forming these divisions, although there are some very important phylogenetic considerations to be derived from their study. In this respect an advance has been made here by limiting one of these sub-families to genera in which a definite and outstanding form occurs.

Key to subfamilies of the *Tachinidae*.

- | | |
|---|--------------------|
| 1. With sternites broadly visible | 2 |
| With sternites much reduced, at least some being concealed by the tergites meeting ventrally | 3 |
| 2. Abdomen without bristles, usually rather broad and dull coloured, but if bright red, a carina may occur, never otherwise. Arista always bare. Small species | <i>Phasiinae</i> |
| Abdomen with bristles. Carina present or absent. Arista bare to plumose. Mostly large and medium sized showy flies | <i>Ameniinae</i> |
| 3. Aedeagus in two parts, the apical section being hinged to and articulates with the basal part. Carina usually present, but if absent, the arista is usually plumose or pubescent, rarely bare | <i>Dexiinae</i> |
| Aedeagus otherwise formed. Carina almost invariably absent, but if present the wings are heavily marked with a dark pattern. Arista usually bare but varies to long pubescent and some with plumosa arista (hitherto placed in <i>Dexiini</i>) may belong here too | <i>Tachiniinae</i> |

SUBFAMILY DEXIINAE.*

This subfamily is to be restricted to all those genera that contain species with the aedeagus of a definite type. This consists of a stiff slender basal part and a well defined apical part that is hinged to the basal and articulates with it. This apical part may be short or long, and in the latter case very flexible, like a very supple cane. It occurs in a large number of genera of which *Rutilia* and *Prosenia* form two, well represented in Australia. There are certain genera without a carina that may have to be removed and two are now definitely ascertained to be *Tachiniinae*, namely, *Sumpigaster* and *Zosteromyia*. These genera are dealt with in the following key:—

Key to genera hitherto incorporated under *Dexiini*, Section 2.

- | | |
|---|------------------------|
| 1. With a large flat facial carina between antennae.
Section 1. <i>Prosenia</i> and allied genera. | |
| Without a carina. Section 2 | 2 |
| 2. First and fifth radial veins with a series of bristles on upper side | <i>Therairia</i> Desv. |
| At most only the fifth radial vein with a series of bristles on upper side | 3 |
| 3. Abdomen stoutly conical, almost contiguous with hind coxae at base | 4 |
| Abdomen slender and much more remote from hind coxae at base | 6 |
| 4. Arista long-plumose; parafacial and parafrontal region with hairs; palpi well developed and clubformed | <i>Apatemyia</i> Macq. |
| Arista long-plumose; only parafrons hairy; palpi rather short, not clubformed | gen. ——— |
| Arista pubescent but may appear bare. Parafacial and parafrontal region without hairs; palpi well formed and clubform | 5 |

*I do not know if genus *Dexia* has the character cited here, and if not the group will need another name.

5. Propleura bare *Heterometopia* Macq.
Propleura hairy (a unique character in this section) ? *Toxonemis* Macq.
 6. First abdominal segment without bristles *Sumpigaster* Macq.
 First abdominal segment with a pair of long strong median
 marginal bristles *Zosteromyia* B. & B.

Presumably genus *Hobartia* Malloch, also comes within this second section, but it is very indefinitely described.

Genus *Therairia* Desvoidy.

Three species are before me, one probably *T. australis* Walker. It may be a more primitive form than the usual *Dexiinae*, for it has been variously treated by authors, nevertheless, a specimen with the genitalia extracted shows that the aedeagus has the two hinged parts.

Genus *Apatemyia* Macquart.

Macquart, Dipt. Exot. suppl. 1, 197 ; Pl. 17, f. 4, 1846.

This was originally placed by Macquart amongst the *Calliphoridae*, but there can be no doubt that its affinities are with the *Tachinidae*, being one of perhaps five genera that have many characters in common. Its position amongst the *Dexiinae* requires confirmation. There is only one described species, but two others are known to me, all being rare in collections.

Apatemyia longipes Macquart.

Head : seen laterally, the line of the frons runs very straight to the base of the antennae, forming there a right angle with the line of the face ; the latter curves outwards to the oral margin. The carina is not developed and the first two segments of the antennae are about equal in length, very short, and the third is long, reaching nearly to the line joining the vibrissae. The arista is abundantly provided with long hairs, the proboscis is short, and when fully extended its apical part is about equal to its basal part, the whole being hardly longer than the depth of the head. The palpi are long, slender and club-shaped, about as long as the apical part of the proboscis. The cheeks are well pronounced and formed as in *Heterometopia*, but the whole outline of the head is more trapezoidal in shape than in that genus. There are no marked bristles on the yellow head other than those bordering the frontal stripe and those associated with the vibrissa, the two pair of verticles and the postoculars. Hairs are plentiful on the dark frons, down each side of the face to near the level of the lower margin of the eye, where there is a short bare space followed by more black hairs that give place to the yellow hairs that abound behind the eyes.

The whole dorsal area of the thorax is black with faint indications of striae ; the lateral border of the dorsum is thickly covered with a pulverulent grey that permeates the whole of the pleura, which is otherwise also black ; the dorsal hairs are rather long and most of the bristles are slender and hence some are not easily detected, those seen being :—3 presutural, 4 postsutural acrostichals, and a similar number of dorsocentrals ; 4 humeral, 3 posthumeral, 2 notopleural, the presutural not detected, 3 supra-alar, 4 intraalar and 2 postalar. Two pairs of scutellar bristles are widely separated along the margin, and between them one pair of slender submarginals, much weaker but nearly as long. On the pleura there are four strong bristles immediately above the anterior coxae and some weaker ones ; the mesopleura

has the usual row near the base of the wing well developed and another bristle not far from the anterior spiracle; on the sternopleura the bristles are arranged 2 : 1; the hypopleural row is well developed and there are no bristles or hairs on the sclerite above the posterior spiracle.

The abdomen is yellow with a more or less interrupted uneven black stripe, broad at the base immediately behind the scutellum, the outline being concave to the apical margin of the first segment, the black occupying a third of the width there seen from above; on second segment a little narrowed at base, widening slightly to apex, very much narrower at base of third segment, but widening sharply to occupy the whole width visible from above at the apical margin; the fourth tergite almost wholly black, leaving an apical edge and the sides yellow, but this ground colour is overlaid by a pulverulent yellow. The sides of the tergites meet below so that only the basal sternite is exposed, but small, and all the abdominal hairs are black.

The abdominal bristles are:—3 pair of lateral bristles on apical margin of first segment, 1 median pair and 3 laterals on margin of second segment, third segment similar to second, but another pair placed half-way between median and laterals; fourth segment with a fringe of apicals. Also there are some long weak lateral bristles placed more basally amongst the long hairs of the two last segments, and these are repeated on two undescribed species and therefore may have some generic significance.

The legs are yellow with tarsi more or less black, the wings are hyaline, the venation being like that of *Heterometopia* but the fourth vein is well separated from the third which has three setae at its base on the upper side and one below. The anal vein is reduced to a very short stump.

Hab.—Tasmania: Hobart, 15th October, 1916, 1 male upon which the above description is based. Geeveston, 24th December, 1914, a male having a more slender stripe on abdomen. Allied to this are two more species, one from Victoria and one from Queensland.

Genus *Zosteromyia* B. & B.

Brauer & Bergamstamm, Denk. Akad. Wiss. Wien, lviii, 1891, pp. 376, 406 and 425; lx. 1903, 130.

This genus and *Sumpigaster* Macq. are clearly not *Dexiinae*, but should be relegated to the *Tachininae*. All the species described below are either black or black and brown forms that have silvery or golden transverse bars across thorax, one adjacent to the transverse suture and the other to the scutellum, making them readily picked out. Other species having this, contain also the first median vein running into the lowest radial vein before the wing margin, whereas in the present case these veins run separately to the wing margin or else the abdomen is almost contiguous with the hind coxae, not remote from them. These are well known bush and garden flies that frequent broad leaves over the surface of which they move quite actively and the peculiarity of their markings makes them especially noticeable.

Key to species of *Zosteromyia*.

- | | |
|--|---|
| 1. Arista long pubescent; abdomen black with silvery bars at segmentations | 2 |
| Arista bare | 3 |

2. Summit of frons on male one-sixth head-width. On female, eye margins strongly bowed, the face being much narrower than the frons. Silver fascia of abdomen narrow, never reaching discal bristles *cingulata* Macq.
 Summit of frons on male one-quarter head-width. On female, eye margins hardly bowed, the face being as wide or wider than frons. Silver fascia of abdomen wide, reaching discal bristles *fasciata* n. sp.
3. Face and antennae short, the third antennal segment being less than twice the length of the two basal segments. Female with eye margins diverging along frons, but contracting somewhat on face. Abdomen largely brown *brevifacies* n. sp.
 Face and antennae long, the third segment being three or four times the length of the basal ones. Female not known 4
4. Summit of frons on male broad, one-quarter head-width. Antennae inserted at half eye-depth *longicornis* n. sp.
 Summit of frons on male narrow. Antennae inserted higher 5
5. Abdomen black *minor* n. sp.
 Abdomen largely brown *morgani* n. sp.

Zosteromyia cingulata Macquart.

Myobia cingulata Macquart, Dipt. Exot. suppl. 4, 1849, 206 ; Pl. 19, fig. 1.

On male the summit of frons is one sixth the head-width and the arista long pubescent. The eye margins from summit to quarter the frons, somewhat converging, then diverging to base of antennae from where they still diverge down face but at a lesser angle. The antennae, inserted at two thirds eye depth, reach a little way beyond half the distance to the oral margin where the face width is equal to its length.

A black species with silvery white parafrons, face and occiput, a similarly coloured presutural bar that extends on to the pleura right round thorax, and a similar prescutellar bar. Narrow silvery basal bands occur on the second, third and fourth abdominal segments. Legs deep brown or black.

Female similar but eyes much wider apart at summit, thence bowed but coming nearer together across face where they are noticeably closer together than at the summit.

Hab:—Queensland and New South Wales. Although a very abundant well known fly, about a dozen specimens only are before me and are dated from August to December ; it is, however, to be met with most months of the year.

Zosteromyia fasciata n.sp.

On the male the summit of the frons is one quarter the head-width and the arista long pubescent. Eye margins about parallel for about two thirds frons then diverging abruptly till level with antennae, thence diverging to a lesser degree. The antennae, inserted at two thirds the eye depth, reach to two-thirds the way towards the oral margin where the face is as broad as long.

Markings as in *Z. cingulata*, but the silvery bars on thorax are tinged with yellow, and those on the abdomen are much broader, covering half the second and third segments and almost the entire fourth.

The female is similar, but at the summit the eyes are very wide apart, the margins run parallel to near the oral margin where they tend to come closer together.

Hab.—Tasmania : Hobart, Mt. Wellington. Very abundant in the island, but only three males and one female are in the type series. Victoria : Melbourne, 1 female.

Zosteromyia brevifacies n.sp.

On male the summit of frons is one sixth the head width and the arista bare. The eye margins are as in *Z. cingulata* but the face is wider than long.

Markings as on *Z. cingulata*, but those of the thorax dorsally are golden, and the pleura is covered with a pulverulent white so that the anterior bar does not stand conspicuous there. The abdomen and at least part of the legs are brown. On the former black markings occur dorsally, being in the form of a more or less triangular spot on each of the two basal segments and an apical black bar on the third, but these markings may be more or less diffused.

Female similar, but eye margins bowed similar to those of *Z. cingulata* and the width across the face is noticeably wider than the width at summit.

Hab.—Tasmania ; Mt. Wellington, 2 males, 1 female, January, 1924. New South Wales : Tooloom, January 1926, 1 female (F. A. Perkins) which seems to be identical.

Zosteromyia longicornis n.sp.

On male the summit of frons is one quarter the head width and the arista bare. The eye margins are parallel to half frons length, thence diverging without further alteration towards lower eye border. The antennae, inserted at half the eye depth are long and reach two thirds towards the oral margin where the face is as wide as long.

Markings on the thorax as on *Z. cingulata*, but the abdomen is brown with a broad uneven black stripe that extends on to the fourth segment. The legs are black and the wings rather heavily suffused with black.

Hab.—Queensland : Brisbane and Mt. Glorious, January to April, 1930, 1932. 3 males, two being in the collection of Mr. F. A. Perkins.

Note.—From Tasmania comes a similar form represented by a single specimen in rather poor condition, with a frons even wider than the present one and evidently related.

Zosteromyia minor n.sp.

A very small species, barely 5 mm. long (other species go up to 8 mm). and the male has its summit of frons only one seventh the head width. The arista is bare. The eye borders slightly diverge to one third the frons, thence diverge to a greater extent to lower eye border without further alteration. Antennae, inserted above half eye depth, are as long as half the head depth and reach practically to the oral margin where the face is less broad than long.

Markings as on *Z. cingulata*, but narrower and the pleura is more or less covered with a pulverulent grey.

Hab.—Tasmania : Strahan, February, 1924. 4 males.

Zosteromyia morgani n.sp.

On male the summit of frons is one fifth the head width, otherwise the head characters are as on *Z. minor*.

The markings and colours are also similar, except the abdomen is brown, not black, and with a narrow median black stripe on all segments, widening from a point at base towards apex and on the last two segments there is an apical black bar. The golden bands at base of the segments are lost in the general brown colour.

Hab.—New South Wales. Three males bear the following information on the label.—“bred from *Aulacophorus hilaris* adult, Coll. Binniguy, 22.2.30, W.L.M.” Another male is similarly labelled but the latter part has substituted “Coll. Worara, 11.11.30, W. L. Morgan.” Three of these contain the puparium and all were submitted for identification by the Department of Agriculture, Sydney.

It has long been suspected that *Z. fasciata*, on account of its habits and abundance, is parasitic on beetles of genus *Paropsis*, and the same may apply to *Z. cingulata*. The present record of a species being bred from another Chrysomellid beetle is therefore of special interest.